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MOVING AN ARCTIC TOWN - THE PROBLEMS OF AKLAVIK

by
Gordon Robertson, Deputy Minister of the
Department of Northern Affairs and National Resources

to
The Royal Canadian Institute, Convocation Hall,
Toronto, March 10, 1956.

Canada is growing.

There can be no easier platitude, no safer subject for the public speaker than the remarkable growth which characterizes Canada's history in the mid-twentieth century. Every magazine, every daily paper, almost every news broadcast on radio or television is a reminder of our national growth. It is a growth in many ways - an economic growth, a cultural growth, a growing stature in world affairs, a growing sense of nationhood at home.

The physical aspects of the growing Canada are everywhere about us. In expanding towns and cities, in new industries, in building, in projects of vast scale to harness our natural resources.

This era of national growth is affecting the northern part of Canada profoundly. It may seem curious that this northland which has so long been with us should only now be exciting the imagination of Canadians. It is a country of absorbing interest, partly because of the strangeness of the land, partly because of the people who live in it. It is also of direct material interest because of the wealth which lies beneath the ground.

Europeans knew parts of the north as early as our more southern and eastern regions. For centuries explorers tried in vain to find a route to the riches of the Orient which might be shorter and which would certainly be safer than a south Atlantic commanded by Spanish and Portugese galleons. The merchant adventurers never found that passage, but in the course of their voyages they brought our first acquaintance with the Arctic.

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It is little more than half a century since the north first had any economic importance to the world outside. Whalers from across the seas and from the United States reaped their harvest both in the eastern Arctic and near the mouth of the Mackenzie River. Fur traders gradually pushed through the bush and on to the barrens, and as they did so they steadily changed the way of life of the people.

Until the last World War, however, the north was still largely untouched and unknown except to the relatively few traders, missionaries and administrators who made their homes in lonely outposts.

Meanwhile we had been accumulating knowledge of the north and much of that knowledge was calculated to inspire extravagant dreams of a mineral rich future. The rush to the Klondike in 1898 brought the fame of northern gold across the world. The bright hopes then raised were not entirely fulfilled, but as the years passed by, other resources were found and exploited, resources on which a more stable economic future could be laid. Though even now we know all too little of the minerals of the north in detail, we think we know something of its general potential, and a great potential it is

The opening up of the north is now taking place not only because it is now that our knowledge of resources permits it. It is coinciding with that phase of our national development during which northern development is not only a practical possibility, but almost an inevitability. In the days when Canada was young, when we were pushing our frontiers to the west, when we were peopling the empty prairies, there could be no thought of stretching our slender resources into the million and a half square miles which lay beyond the sixtieth parallel. When our energies were occupied by two world wars, by problems of consolidation and economic depression, the future dreams had to be laid aside. Now, however, the time has come for the beginning of their fulfillment.

In the Northern Territories today, there are only about 25,000 people. Of these about 8,000 are Eskimos, scattered across the tundra from Aklavik in the west to the easternmost tip of Baffin Island. The rest

of the people are for the most part in the Yukon (whose population is 9,096) and in the Mackenzie Valley - Great Slave Lake area. Around Great Slave Lake are important mineral deposits, some of them already exploited. There are three producing gold mines at Yellowknife; what are probably the largest deposits of zinc-lead ores in North America are at Pine Point on the south of the Lake. The attention of industrialists is therefore being focused here particularly. This region may have but a fraction of the wealth of the great Canadian Shield lying to the east, but it has the advantage of reasonable accessibility. When a railway joins Great Slave Lake with the end of steel in Alberta, there will be rapid economic development. The character of northern development has in the past been bound up with transportation and so it will in the future. The Mackenzie River system is the second most important water route in Canada, linking northern Alberta with the Arctic Ocean. It was along this route that the fur trade naturally developed more quickly than in the rest of the Northwest Territories. Before the airplane, the river was the only reasonable method of long distance travelling; and since the airplane, it is still the cheapest, despite the disadvantage of ice for eight months of the year. Along the Mackenzie therefore sprang up communities of whites and Indians, their economy largely based on the fur trade. In this area the fur trade will continue to be of economic importance as long as there is any market for wild fur. The Mackenzie River is now gaining a new importance as the supply route for the DEW Line. Even after the line is built, it must be maintained and the Mackenzie River will play an important part in carrying the freight needed in the western and central Arctic.

As the frontier life gradually changes, therefore, the communities along the Mackenzie River are likely to grow and to assume new roles, and by far the most important community on the Mackenzie is the northernmost of all, Aklavik.

Aklavik is on the Mackenzie Delta, the last town before the Arctic Ocean. It is sharing in the growth of Canada, in the development of the new north west. It is about Aklavik that I wish to speak tonight, nor only

because of its intrinsic importance in the area which it serves, but because I venture to think that you will be interested in some of the problems which arise when an Arctic town tries to grow and meets the problems peculiar to the north.

Aklavik was originally established in 1912 as a trading post. Then, as today, the muskrat was the principal object of trappers' attention. Aklavik began to grow and through its earliest years its growth had a special interest. It was one of the very few places in Canada where Indians, Eskimos and whites lived side by side. Ordinarily, Indians prefer not to live beyond the area of trees and Eskimos are unhappy about venturing inside the treeline. At Aklavik, which is on the very edge of this important boundary, the two groups meet and share a community. The only other place in Canada where the same thing happens to any extent is more than 2,000 miles away - at Great Whale River on the southeast corner of Hudson Bay.

The original site of Aklavik was chosen almost accidentally because it was roughly midway between Fort McPherson already an established trading post, and Herschel Island, important in the days of whaling. The original site was changed once by common consent and the few buildings were moved to where the town now stands. Between 1919 and 1926, Anglican and Roman Catholic missions, a station of the Royal Canadian Corps of Signals, and a Royal Canadian Mounted Police post were established. Gradually, this became the most important community in the western Arctic. It has extensive medical and educational facilities and has become the principal administrative center, while remaining the focus of the muskrat trapping of the Mackenzie Delta. Its permanent population is only about 700, a population which more than doubles with the return of the trappers and their families in summer. By standards in southern Canada Aklavik is a small town, but it is the largest Canadian community within the Arctic Circle and is assuming new significance to the development of the north west. It is growing rapidly and that is where our problem begins.

The problem and special interest of Aklavik is nor merely that it is an Arctic town, but rather that so many northern problems are focused in its expansion.

Aklavik lies on a bank of frozen silt which juts into the west channel of the Mackenzie River. It is in the midst of a delta formed by deposits made over the centuries on the river bottom. From the air one looks down on a vast confusion of lakes stretching over the horizon and laced together by dark green patches of spruce forest. Below, the brown waters of the Mackenzie wind down to the sea. Far in the distance is the ocean on the north, and the peaks of the Richardson Mountains form a backdrop in the west.

This is the very edge of the bush. To the south and west spruce, balsam, poplar, some birch and thickets of alder and willow grow. The trees are smaller than they are further south and are interspersed by short grass, mosses and native flowers. There are open patches of meadows which cannot support even the willow or the alder. Just a few miles north and east the trees end and the Arctic barrens begin - treeless and open.

Although the ocean is only 60 miles away, the climate of the Delta is continental with low winter temperatures, and warm, short summers. Winter begins in late September and lasts for at least seven months. Only 60 days of the year are free of frost. The annual precipitation, in terms of water equivalent, is about nine inches. The average annual snowfall is no more than in Toronto. Although the winters are long, in general the climate of the Delta is relatively pleasant for a place approximately 100 miles north of the Arctic Circle.

Aklavik is built on permafrost. During the last glacial age the soil of the north was frozen to tremendous depths. Over the centuries it is slowly thawing, but where Aklavik lies the frost stretches down a thousand feet. There is, of course, permafrost extending across the whole of Arctic Canada, and a good bit of the sub-Arctic, south of the treeline. The top two or three feet, known as the "active layer", thaws in the summer and freezes again in the winter. Below that, the ground is permanently frozen.

Permafrost is always a problem in construction, but it need not present critical difficulties if the nature of the frozen soil is right. In Aklavik it is all wrong.

The present town rests on a mixture of frozen silt and ice. There is more ice than silt, and so it can be said that Aklavik is a town resting on the water.

This is not much of an exaggeration, for when the ground heats up either from the rays of the sun in summer or from radiation of buildings, the ice in the soil melts. There is nowhere for the water to run. It will not drain down through the silt and, in the low, flat area, there is no drainage for it to run off. Hence immense pools of water form surrounded by thick mud. Among the local residents, Aklavik is a little disrespectfully known as "the mudtropolis of the Arctic".

The pools of water, the mud, the poor drainage are much more than an inconvenience. They prevent the construction of roads needed for the community's welfare and the building of sewers and water mains vital to the community's health. On this type of ground an airfield is out of the question except at enormous cost. Aklavik is therefore cut off from the rest of the world for six weeks during breakup and freezeup each year when planes are unable to land on the Mackenzie River and dog teams are unable to cross. In those three months each year anything could happen in Aklavik, and on one could get in or out.

This isn't the end of Aklavik's dilemma. While the very foundations of the community seem to be melting away in a welter of mud, its edges are being eroded by the action of the Mackenzie River. What, in the circumstances, could Aklavik do?

For most Canadian communities the problem of expanding can be solved by either vertical growth, that is by constructing tall apartment and office buildings, or by horizontal growth, that is by spreading over an adjacent area and thereby creating new suburbs. In the present Aklavik neither is possible.

Obviously on ground as unstable as the Mackenzie Delta no one is going to think of skyscrapers, even apart from the construction problems. Horizontal expansion is equally out of the question. The river is a moat, a tightening moat hemming in the community more and more as the years go by.

With the passage of time the situation gradually became more and more untenable. Decisive action was prompted when, two or three years ago, Aklavik was faced with the necessity of large new investments in construction, all more or less at the same time. Some were government, some missionary, some private. The present site of Aklavik was no place for a substantial building programme. There was only one answer - the town had to move. The only question was - where?

DECISION TO MOVE

Early in 1954 a survey team was organized to find a suitable site for the proposed new town of Aklavik. Eleven criteria were set up by which potential sites were to be judged by the team. The new site was to be a place conducive to orderly, efficient, and economical town planning. The ground would have to be suitable for permanent sewer and water systems, foundations and roads, and there would have to be a good site for an airfield. If possible we hoped the site would allow for adequate sewage disposal, that gravel and sand for building purposes would be fairly accessible, and that the site would be located where it could act as a trans-shipment point from river to sea-going vessels. We also hoped to find a place where wood, coal and hydro-electric power were reasonably accessible.

Nine possible areas were considered by the site survey team, and five were quickly eliminated. The remaining four were estensively investigated, and one by one they were judged on the basis of the eleven criteria. Finally a site was chosen. This site, "East 3" as it was known by the team, was located on the east bank of the east

channel of the Mackenzie River, 35 miles east of the old Aklavik by air, and 70 miles by water. This location fills all the essential and highly desirable requirements. When the new town of Aklavik is completed, there will be no more danger from flooding or eroding, there will be a safe water supply, and there will be sewer and water distribution lines. There is room for future expansion, and perhaps most important of all, an airstrip nearby which can be linked by road to the community. The new site is situated on a good navigable river channel. Above all, the soils, instead of being composed of silt and ice, are mainly gravel and ice - a combination that may not sound highly attractive to southern ears, but which lessens the danger of heaving and settling in buildings.

ENGINEERING STUDY

After final approval was given to this site, the next job was up to the engineers. They had to make an engineering study of the problems peculiar to this unusual town. Some of these problems are particularly interesting, especially if we compare them with similar situations here in Toronto.

Road building in southern Ontario, for the most part, is a relatively simple and routine matter. In most places solid base can be laid, and drainage is a matter of routine. But in the new Aklavik road construction gave the engineers a major problem. They would have to build their roads without destroying that all-important insulating cover of moss - a layer often a foot or more thick. If the moss is disturbed, the permafrost will melt, to a depth of several feet in the summer sun. Even with gravel soil, the high water or ice content means that the soil becomes very unstable once it is thawed to any depth, and, having thawed, when it re-freezes in the Arctic winter it may heave and move in a fantastic fashion. It was decided to lay the gravel on top of

the moss, taking great care that this insulating layer was not disturbed. In some areas the brush obtained from clearing the land was to be laid on the moss as a protective mattress before the gravel was spread on top. Drainage had to be provided, but ditches were undesirable since they too involved removal of the moss. The roads were therefore planned to follow the natural contours of the land so that drainage could be by run-off, without any ditches if at all possible.

Buildings too present special problems in permafrost. Sturdy foundations can be constructed in this part of the world by excavating either a large basement area with concrete walls or trenches for concrete footings. But not in Aklavik, Basements would cause thawing and the melting permafrost would play havoc with the walls or footings. These problems have been met before in the Arctic and, after extensive study three possible solutions have been found: pilings, gravel pads, and spread footings.

"Spread footings" are somewhat similar to ordinary concrete footings except that the base is spread to obtain increased strength. However, in the conditions of the new Aklavik, the engineers recommended that they be used very little, if at all. "Piling" was more hopeful. Wooden piles twenty to thirty feet long could, for the most part, be obtained in the delta within thirty miles or so of Aklavik and either brought by barge or floated to the site, thereby saving high transportation costs. Pilings will be used for most large buildings. The first step is to melt out holes twenty feet deep in the permafrost with a steam jet. Then the piles are driven down into the thawed mud with a pile driver. The piles set in the re-freezing ground in six weeks, but if they are driven in the summer, it takes a year before they are solid enough for buildings to be put on them. The buildings will then stand on stilts, giving an appearance somewhere between a primitive bush house and the most modern ideas of LeCorbusier. The stilts will be thoroughly functional, not only saving the insulating cover of the soil, but providing a breezeway between floor and ground. The breezeway will let the wind disperse the heat from the building which would otherwise melt the permafrost and undermine the foundations. Relatively small houses can be built by a less expensive process than pilings. A two-foot gravel pad is laid on the moss, and the building put on top. The pad will allo

enough air circulation to dissipate heat from the building. Although there may be some shifting, if the building is made reasonably rigid this type of foundation will be acceptable for small buildings.

Probably the most formidable challenge was the design of sewer and water mains. Here in the Toronto area where the average frost depth in winter is only about three feet, water and sewer mains can be installed below the frost line and there they are safe from freezing. At Aklavik, where the permafrost is a thousand feet deep, the frost line is a bit too far down - about 990 feet too far. Any pipes buried in the ground would freeze solid - in summer as well as in winter - unless they were thoroughly insulated, and even then the fluid in them would have to be warmed. There would be no point in burying them and the problem of repairing and servicing them under the rock-like permafrost would be enormous. Some other answer had to be found.

The solution came in the form of "Utilidors", which have already been used in other places in the north. These are large, insulated, box-like enclosures through which the sewer and water pipes run above the ground. However, insulation alone is no adequate precaution in the long, very cold winters of Aklavik. It was clear that, if the pipes were not to freeze, the water in them would have to be heated, and kept warm enough through all the length of the town's sewer and water system that it would stay above freezing. In short, there had to be, not simply the ordinary cold water pipe that we have but a warm water pipe. But if you are going to be circulating warm water through a whole town, why not go the full distance and use the warm water to heat the town as well? That is the solution that has been adopted. The Utilidors will carry not only the pipes for sewage and water, but also heat from a central heating plant. Design will be such that the heat which escapes from the heating lines, combined with the insulation in the Utilidor itself, will eliminate the danger of freezing even during the most severe winter weather. The Utilidors will run on stilts above the ground, leaving a breeze-way underneath so the permafrost will not melt.

Putting a sewer and water system up in the air raises new problems. Every time a road and a Utilidor have to cross a bridge will be needed. It was, therefore, necessary to plan the system of roads and Utilidors to have as few crossings as possible. When they do cross, the road will take to the air too - and go over the Utilidor.

With Utilidors permanent residents of the new Aklavik can have their homes heated from the central heating plant. They will have modern sewage facilities. Perhaps most welcome of all there will be an end to the tedious job of chopping cakes of ice and melting them to get drinking water - the process that has been necessary until now. Hot and cold running water will, for Aklavik, be a luxury. Central heating will be almost as much a comfort. The heat for the town will be generated in the same plant as the electricity, which provides great economies. The steam for the electric generators will be used twice - once to turn the generators, and then to warm the town. Oil or coal will be the fuel but the possibility of converting the plant for the use of atomic fuel at some future time will be kept in mind.

Of course there may be disadvantages in central heating in the Arctic - the main one being the possibility of heat being cut off from many buildings in the event of a breakdown of the central heating plant. A number of standby boilers and diesel electric generators will be strategically located to take care of any emergency. However, experience has shown that the possibility of breakdown is much less in a large plant than in a smaller one. When everything is finished, the new Aklavik - or most of it - will share one quality (and only one) with a tropical community. The houses will need no furnaces and no chimneys.

One of the most valuable animals in the north, the dog, also provided headaches for the engineers. For many Aklavik residents, dog teams are as important as cars are to us. Moreover, the dogs are not the amiable house-pets we know. They are large, strong and fierce. A northern dog can be a dangerous animal. In the old Aklavik each resident is responsible for keeping his own dogs tied on his own property. This affects the whole layout of a town for it means that relatively large lots are needed. The dogs have to be tied far enough apart that they cannot get at one another, for their favourite pastime is tearing one another apart. In the serviced part of the new town, compactness will

be essential to efficiency and economy. When Utilidors cost between $100 and $200 per foot, they cannot amble about to suit the convenience of a host of dogs. Large lots are out, but the dogs have to be housed somewhere. The solution is the construction of a dog corral. The community parking area will have torn ears and the smell of fish instead of bent fenders and the aroma of gasoline.

Earlier I mentioned that the population of Aklavik swells in summer from about 700 to 1500 with the influx of many trappers who do not live there all year. The planning study had to consider temporary accommodation for these people during the summer. This accommodation has to be fairly close to a water supply and within easy access of the river, near the center of the town, but not in a place which will cause dispersal of permanent buildings. Such an area has been provided in the plan.

The airfield was one of the major items in the engineering study. It would have to be near to the town; it would have to be open all year-round; and it would have to satisfy many conditions relating to soil structure, slope and drainage. The site that seems most likely is six or seven miles from the town and can easily be linked to it by road. It fulfills all of the necessary criteria, having a rock base which will allow the construction engineers to blast the rock in the high spots and use this rock, crushed, to fill up the hollows. In this way the airfield provides most of its own fill and topping.

RESULTING TOWN PLAN

The plan of the new community of Aklavik was designed for both present and future growth. It will accommodate twenty-five hundred people in its initial stage, with plans for the accommodation of five thousand. Efficiency and economy were stressed throughout, and every effort was made to design the community in such a way that it would comply with the unusual requirements set by the climate, the location and the terrain.

The town plan is divided into areas, each area being carefully designed for the building or service which it will contain. To the north will be a hospital area, sufficiently removed from the town for quiet, cleanliness and privacy. The hospital will be adjacent to a residential area which will provide accommodation for nurses, doctors and other hospital staff. Room for expansion to a maximum of thirty acres will be available for the hospital's future use.

At the present time, only one school of twenty-five rooms will be constructed on the main square of the town. It will provide for educationfrom grades one to twelve and for vocational training as well. Nearby will be hostels, built by the government and operated by the Anglican and Roman Catholic churches, where Eskimo and Indian children attending the school can live while their parents are hunting or trapping in their distant homes. School areas near the outskirts of the town have been provided for the future but whether district schools will later be provided is a matter for further consideration. The main school property contains space for a large playing field, and the school itself will be in one of the recreation areas. These recreation areas are designed not only for the preservation of the best vegetation on the site, but also as fire breaks in case of a serious conflagration.

There will be two types of housing area. In the serviced area, starting near the center of the town and expanding outward in sectors, running water, sewer, electricity, and central heating will be available. All services will have to be taken by the residents in the area. Sewer and water cannot be provided safely unless heat also flows through. In the other area, where people may not be able to afford all the services at the costs that are involved in the Arctic, only electricity will be provided within the houses themselves. To provide other facilities for this area, consideration is being given to the construction of a number of "service centers" to which the residents can go to get their water and to dispose of their sewage. Tank trucks will call regularly to deliver water and remove sewage for disposal.

In the center of the town at the junction of the two main roads will be the town square with retail stores, the R.C.M.P. headquarters, Federal administrative offices and provision for recreational facilities such as a theatre and rinks.. This main commercial area starts at the main square and its development will eventually spread from here down the road to the wharf. A second commercial area, which will contain only a hotel to beginwith, adjoins the subsidiary square.

A central, twenty-five acre storage and industrial area will be separated from the commercial area by a strip of park. This area will accommodate a service station, a repair shop, a woodworking shop, and a laboratory and workshop for game experts. Storage facilities, heated and unheated, and, strange though it may sound for an Arctic town, refrigerated warehouses will be provided. It has also been suggested that it would be of great value to the local inhabitants if refrigerated locker space were made available to them at a reasonable rental. The warehouses will be in the industrial area, near the river. Because most material and supplies will arrive at Aklavik by water, a wharf will be constructed near the warehouses. The wharf will be submerged each spring, but the ice will go out while the river is in flood so that the structure will not be endangered.

The central steam and power plant will also be close to the river so as to be near to the water intake and the storage facilities. The Utilidors have been planned so that the gravity flow will bring all sewage to the central plant through which it will pass before disposal.

Adjoining the central storage area, corrals for the dogs of people living in the serviced housing areas will be available. A separate area has been provided for the large number of dogs belonging to the R.C.M.P.

SCHEDULE OF WORK

The selection of the site for the new Aklavik, the engineering study and the resulting town plan were all components of a programme for

the realization of the new community. Execution of the programme began in 1954 with the organization of the site survey team and the selection of the most suitable location. Last year, 1955, saw the embryo town begin to emerge. The town plan was drawn up, investigations into the location and cost of an airstrip were conducted, brush was cleared from the site while saving all possible trees, and a number of roads were constructed. Some cabins, and a garage-workshop were built and piles were driven and left to freeze in preparation for the 1956 construction programme. Construction materials were stockpiled along with machinery, spare parts and repair facilities.

The plan proposed for 1956 includes more preliminary construction, a legal survey, the clearing of one hundred and twenty acres of underbrush, and the stockpiling of material for future use. Contracts will be awarded for the school, two hostels, possibly the utilities, and for some warehouses. More piles will be set and allowed to freeze ready for construction in 1957. The wharf will be finished in late September. With the completion of the survey and the awarding of a contract construction of the airport will begin. More townsite roads will be built.

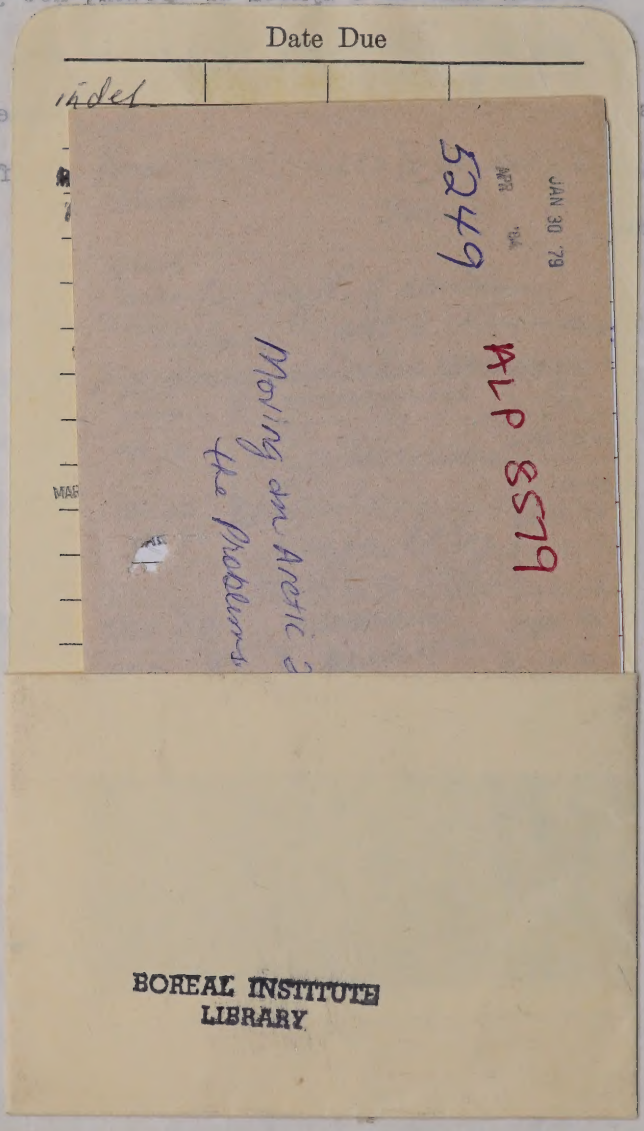
The construction of the new town will go on for several years - probably until 1960 or 1961. It could be done more quickly if it were not for a special consideration. The construction of the town is being used as a training programme to provide vocational skills to the Indians, Eskimos and other people of the area. The fur trade on which they have depended is sick. They must learn new trades. Insofar as possible the work is being planned so that they can build their own town and, in doing it, learn to be carpenters, bulldozer operators, truck drivers and skilled workers of other kinds. The new town is, in itself, an education and employment plan.

The new Aklavik, even more so than its predecessor, will

be an important center for the Canadian north and the people who live there. Situated, on the one hand at the edge of the Arctic Ocean, and on the other at the end of the Mackenzie River chain which links the western Arctic and the Provinces, Aklavik will be important as a transportation center. Materials and supplies will be delivered to the town's front door by ship when the Mackenzie River is open. The airport will not only give Aklavik contact with the rest of the world for 12 months each year, but it will become an important link in the northern air routes. Aklavik will, as in the past, house federal government employees who carry on the administration of the area and who look after the welfare of the Indians and Eskimos. Through its schools it will continue to offer the advantages of secondary school education to Eskimo, Indian and White children living in Aklavik or as far away as Spence Bay - more than one thousand miles to the east. Through the missions, Anglican and Roman Catholic, school hostels and churches will be available. The hospital and rehabilitation center will provide the best of treatment for all who require it. And Aklavik will continue as a trading community, the center of the trapping industry of the Mackenzie Delta.

In other northern nations, Arctic towns and cities are common. In the Soviet Union, Murmansk has a population of 150,000, and there are many other large Russian communities above the Arctic Circle. But Aklavik will be Canada's first modern Arctic town. It is Canada's first attempt to establish an Arctic community of such a character and design that all the benefits of modern science and technology are harnessed to meet the ageless problems of nature so foreign to our experience in the south. In the future there may be other Aklaviks, as the course of national life moves north. Aklavik, we hope, will be a symbol of our success in adapting an urban community to the peculiar demands of Arctic living.

It will also be a symbol of growth, not just of the Western Arctic, but the growth of Canada, from sea to sea. Now Aklavik may serve as a reminder to Canadians that "a mari usque ad mare" to Canadians means not just the Atlantic and the Pacific, but also our third and final boundary - the Arctic Ocean.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